SRT Support in Cobalt Compression Devices

Cobalt 9992-DEC/9992-ENC

Overview

Secure Reliable Transport (SRT) is a legacy protocol for low-latency, reliable transport over the Internet. It was designed by Haivision based on a file transfer protocol called UDP Data Transfer (UDT) and placed in the public domain. It includes the following primary features:

- Two methods for packet loss recovery:
  - Retransmission of lost packets (ARQ).
  - Reconstruction of lost packets using Forward Error Correction (FEC) techniques.
- Optional Pre-Shared Key encryption, using AES, with key sizes of 128, 192 and 256-bit.
- Uses a single UDP port per flow.
- Roles of sender/receiver are independent of client/server.
- Support for "rendezvous mode", where, **in some limited situations**, devices can connect over the Internet without previous firewall configuration.
- Configuration can be negotiated between endpoints.

SRT is known to have lower packet recovery performance than more modern protocols (such as RIST), and is missing important features such as multi-link bonding, seamless switching, multicast support, and authentication.

Rendezvous Mode

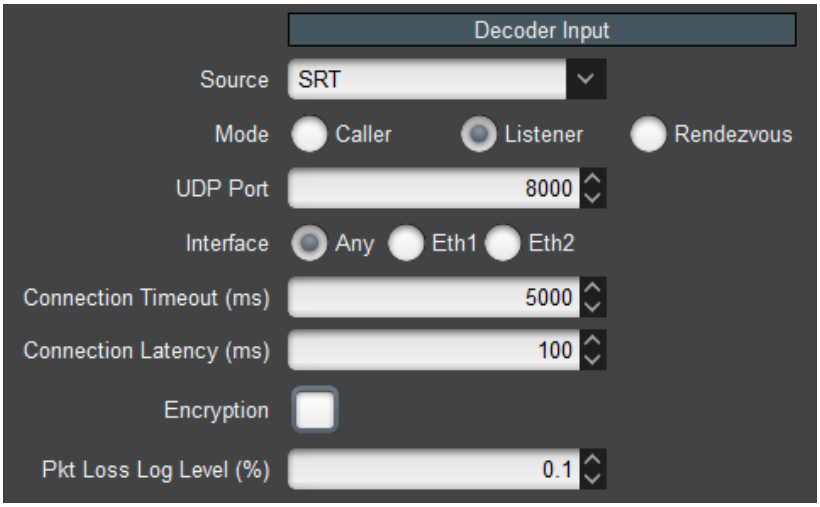
SRT supports a "rendezvous mode", where, ***under very limited situations***, two SRT devices behind firewalls can connect to each other without firewall pre-configuration or port forwarding. For this mode to work, the firewall must not remap UDP source ports. Most modern firewalls **do** remap UDP source ports. The mode is included in Cobalt devices for extra compatibility but Cobalt Customer Support will not be able to assist if this mode does not operate, since it is highly dependent on the firewalls used on both sides of the connection.

SRT Support in the 9992-DEC

By virtue of being a decoder device, the 9992-DEC is always a receiver. However, as far as the SRT connection is concerned, it can be a server ("listener"), waiting to be contacted by the sender, or a client ("caller"), which explicitly starts the connection with the sender. In either case, once the connection is established, the 9992-DEC will only receive. The FEC settings and encryption key length will be determined by the sender.

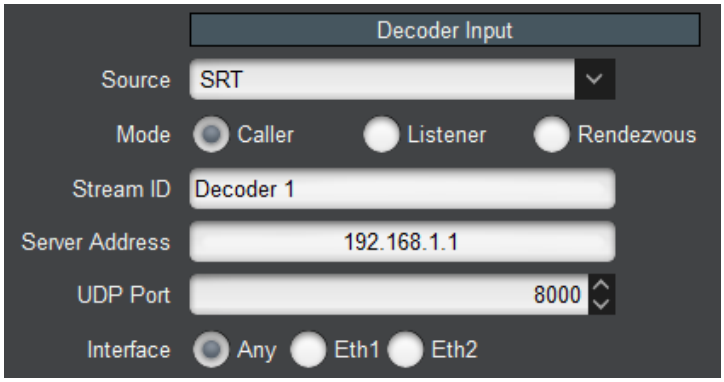
9992-DEC SRT Configuration

The user interface for SRT is displayed below:



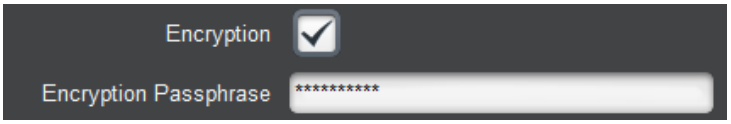
The configuration parameters are as follows:

- **Mode:** This selects between **Listener** (server), where the device will wait to be connected, **Caller** (client), where the device will explicitly connect to a sender, and **Rendezvous**, where the device will attempt to connect to another device in rendezvous mode. If **Caller** or **Rendezvous** are selected, new fields will appear, as indicated below:



  - **Stream ID:** this is an arbitrary string sent from the caller to the listener, for identification purposes. In rendezvous mode, the Stream ID of one of the endpoints is arbitrarily selected for the connection.
  - **Server IP Address:** this is the IP address of the server ("listener") to be contacted.
- **UDP Port:** This is the UDP port to be used for the communication. If the decoder is a **Listener**, it will listen on this port for incoming connections. If it is a **Caller**, it will connect to this port in the server. In **Rendezvous** mode, the specified UDP port is used both to listen for connections and to contact the partner.
- **Interface:** The 9992-DEC has two streaming interfaces. You can restrict communication on one of them, or leave it to the 9992-DEC to choose the most suitable. In particular, if the decoder is a **Listener**, selecting **Any** will cause it to accept incoming connections on either one of the interfaces.
- **Connection Timeout:** This configures the amount of time the decoder will keep a connection open without any data. After the timeout, the connection is dropped and restarted.

- **Connection Latency:** This configures the incoming stream buffer. It should be a multiple of the round-trip time to the other endpoint.
- **Encryption:** Checking this box will enable encryption of the content. When the box is checked, a second field appears for the passphrase:



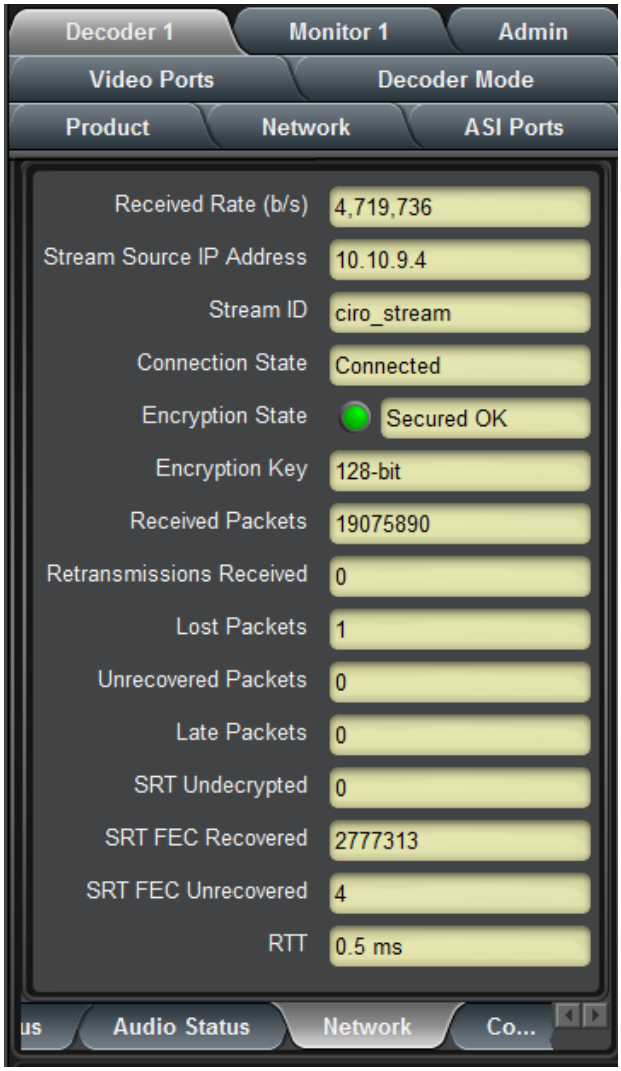
  - **Encryption Passphrase:** Enter the encryption passphrase (minimum 10 characters). It must match the Passphrase at the sender or communication will not be possible.

  Note that the encryption key length will be determined by the sender.

- **Packet Loss Log Level (%):** The 9992-DEC can log excessive packet loss events. If the instantaneous uncorrected packet loss exceeds the threshold, a log entry will be created.

9992-DEC SRT Statistics

Runtime SRT statistics are available in the **Network** bottom tab for that particular decoder, as displayed below:



The available statistics are:

- **Received Rate (b/s):** indicates the current incoming payload bit rate (does not include overhead).
- **Stream Source IP Address:** indicates the IP address of the remote endpoint.
- **Stream ID:** indicates the current Stream ID. If the decoder is in **Caller** mode, this will be the Stream ID configured in the GUI. If it is in **Listener** mode, it will be the Stream ID received from the remote end. If it is in **Rendezvous** mode, it will be the final selected Stream ID for the connection.
- **Connection State:** indicates the current connection state.
- **Encryption State:** indicates the current encryption state. This is an alarm and will be red in error conditions. The text indicates the exact condition.
- **Encryption Key:** indicates the current key size. The key size is set at the sender.
- **Received Packets:** count of packets received so far in this connection.
- **Retransmissions Received:** count of retransmissions received so far in this connection.

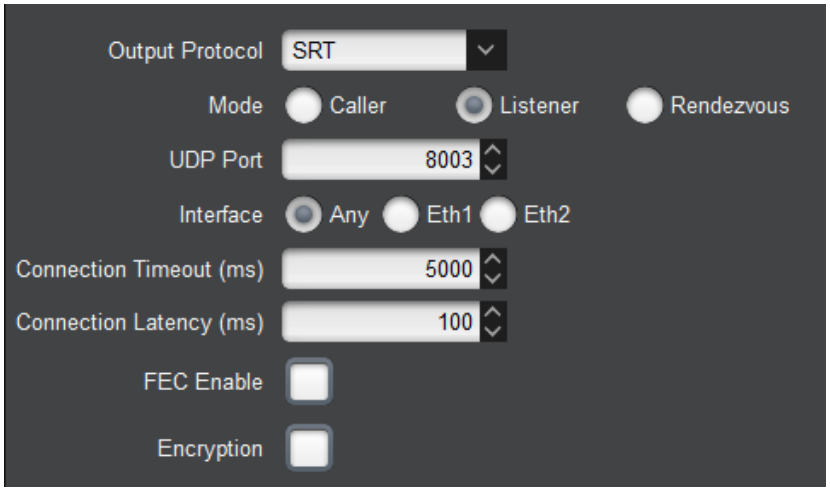
- **Lost Packets:** count of lost packets.
- **Unrecovered Packets:** count of lost packets that the protocol has not been able to recover.
- **Late Packets:** count of good packets that arrived too late (based on the **Connection Latency**) setting.
- **SRT Undecrypted:** count of packets for which the decryption failed.
- **SRT FEC Recovered:** count of packets recovered using FEC.
- **SRT FEC Unrecovered:** count of packets that were not recovered using FEC.
- **RTT:** measured Round Trip Time to the sender, in milliseconds.

SRT Support in the 9992-ENC

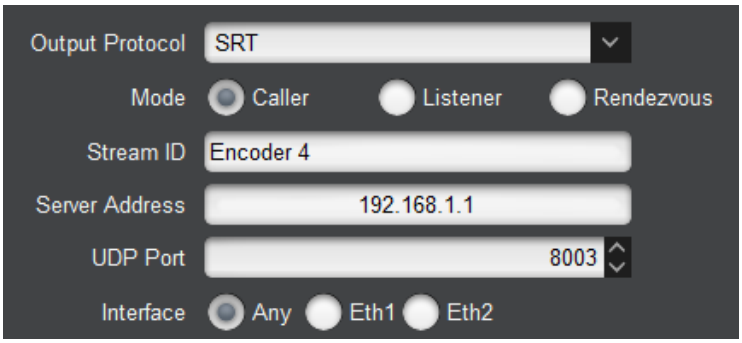
By virtue of being a decoder device, the 9992-ENC is always a sender. However, as far as the SRT connection is concerned, it can be a server ("listener"), waiting to be contacted by the receiver, or a client ("caller"), which explicitly starts the connection with the receiver. In either case, once the connection is established, the 9992-ENC will only send. The FEC settings and encryption key length are configured in the 9992-ENC and transmitted to the receiving device.

9992-ENC SRT Configuration

The user interface for SRT is found in the **Connections** tab and is displayed below:

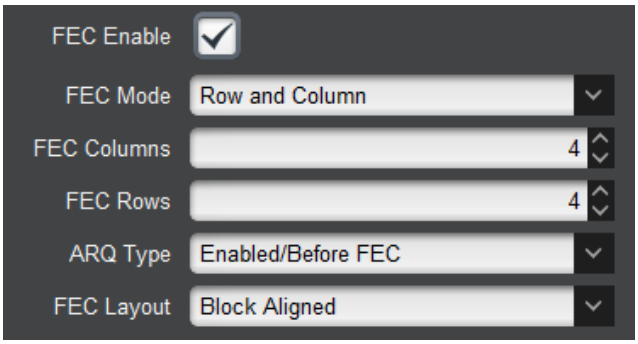


- **Mode:** This selects between **Listener** (server), where the device will wait to be connected, **Caller** (client), where the device will explicitly connect to a sender, and **Rendezvous**, where the device will attempt to connect to another device in rendezvous mode. If **Caller** or **Rendezvous** are selected, new fields will appear, as indicated below:



- **Stream ID:** this is an arbitrary string sent from the caller to the listener, for identification purposes. In rendezvous mode, the Stream ID of one of the endpoints is arbitrarily selected for the connection.
- **Server IP Address:** this is the IP address of the server ("listener") to be contacted.

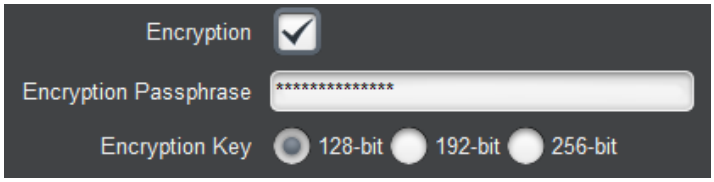
- **UDP Port:** This is the UDP port to be used for the communication. If the decoder is a **Listener**, it will listen on this port for incoming connections. If it is a **Caller**, it will connect to this port in the server. In **Rendezvous** mode, the specified UDP port is used both to listen for connections and to contact the partner.
- **Interface:** The 9992-DEC has two streaming interfaces. You can restrict communication on one of them, or leave it to the 9992-DEC to choose the most suitable. In particular, if the decoder is a **Listener**, selecting **Any** will cause it to accept incoming connections on either one of the interfaces.
- **Connection Timeout:** This configures the amount of time the decoder will keep a connection open without any data. After the timeout, the connection is dropped and restarted.
- **Connection Latency:** This configures the incoming stream buffer. It should be a multiple of the round-trip time to the other endpoint.
- **FEC Enable:** If this box is checked, Forward Error Correction (FEC) is enabled. The following additional fields become available:



- **FEC Mode:** the selections are **Row and Column**, **Column Only** and **Row Only**. **Row Only** FEC is only effective for occasional single packet losses. Column-based FEC (either **Row and Column** or **Column Only**) is effective for burst losses. Please refer to the SMPTE 2022 FEC discussion the 9992-ENC manual for more general details on FEC.
- **FEC Columns:** this selects the number of columns in the FEC matrix. The number of columns determines the maximum burst loss recoverable when column FEC is enabled.

- **FEC Rows:** this selects the number of rows in the FEC matrix. Note that this parameter is not displayed if **Row Only** is selected (because the number of rows is set to 1).
- **ARQ Type:** this selects how ARQ is combined with FEC. The options are **Enabled/Before FEC** (packet retransmissions are requested before FEC is applied), **Enabled/After FEC** (only packets not recovered by FEC are requested), and **Disabled** (the only packet recovery mechanism is FEC).
- **FEC Layout:** select between **Block Aligned** and **Non Block Aligned**. This parameter has a small impact in overall latency, but no impact in packet recovery.

- **Encryption:** Checking this box will enable encryption of the content. When the box is checked, additional fields appear:

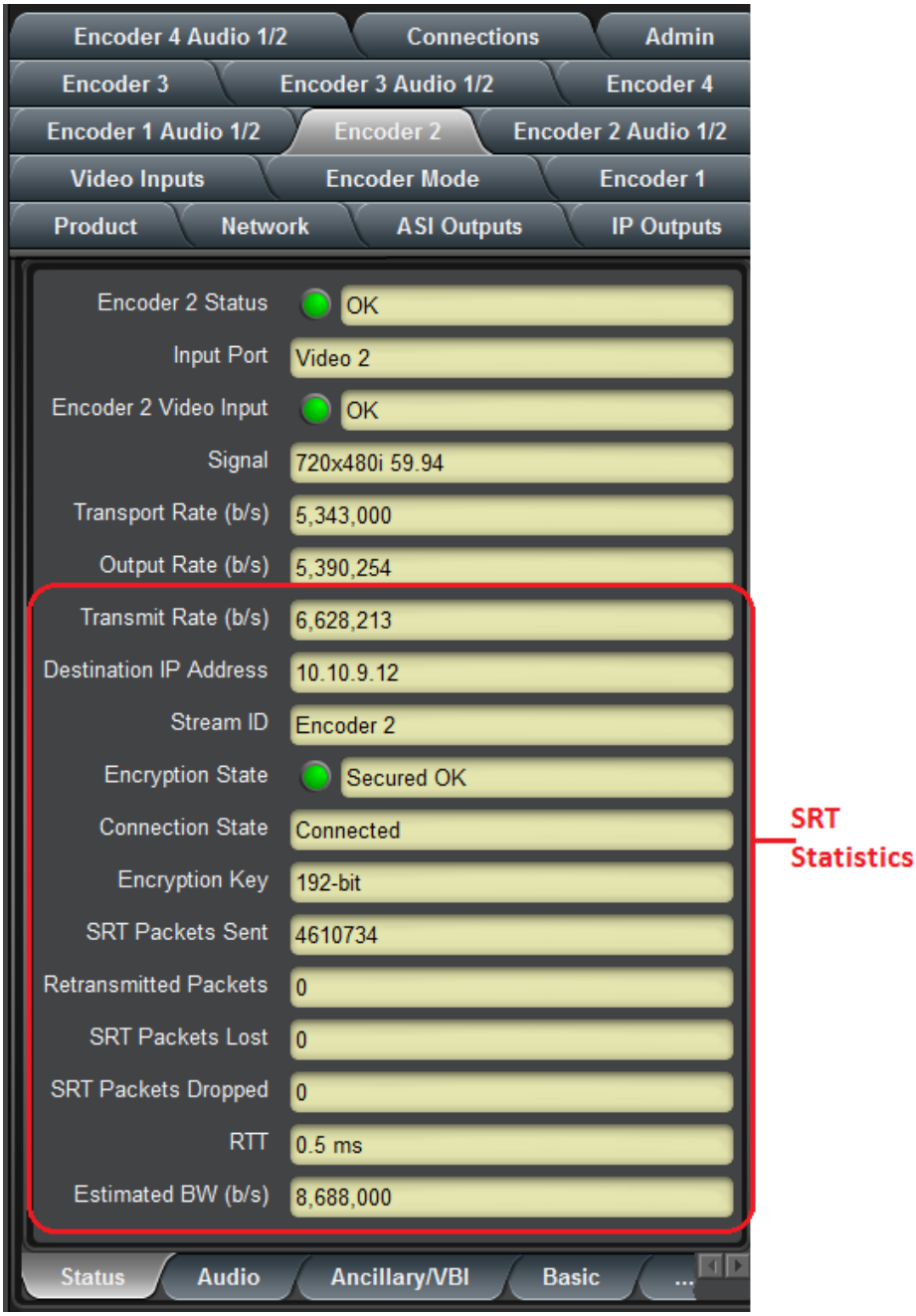


- **Encryption Passphrase:** Enter the encryption passphrase (minimum 10 characters). It must match the Passphrase at the receiver or communication will not be possible.
- **Encryption Key:** Select the encryption key length. Please note that encryption keys of more than 128 bits may not be legal in some countries.

9992-ENC SRT Statistics

The 9992-ENC SRT statistics are shown in the encoder channel **Status** tab. The supported parameters are:

- **Transmit Rate (b/s):** this indicates the total output rate, including FEC overhead (if applicable).
- **Destination IP Address:** this indicated the IP address of the partner receiving the stream.
- **Stream ID:** indicates the current Stream ID. If the decoder is in **Caller** mode, this will be the Stream ID configured in the GUI. If it is in **Listener** mode, it will be the Stream ID received from the remote end. If it is in **Rendezvous** mode, it will be the final selected Stream ID for the connection.
- **Connection State:** indicates the current connection state.
- **Encryption State:** indicates the current encryption state. This is an alarm and will be red in error conditions. The text indicates the exact condition.
- **Encryption Key:** indicates the current key size.
- **SRT Packets Sent:** indicates the number of data packets sent.
- **Retransmitted Packets:** indicates the number of retransmitted packets.
- **SRT Packets Lost:** indicates the number of packets lost reported by the receiver.
- **SRT Packets Dropped:** indicates the number of packets dropped at the sender.
- **RTT:** measured Round Trip Time to the receiver, in milliseconds.
- **Estimated Bandwidth (b/s):** indicates the bandwidth estimated by the SRT protocol. This is not the link bandwidth, which may be significantly larger.


Encoder 4 Audio 1/2
Connections
Admin
Encoder 3
Encoder 3 Audio 1/2
Encoder 4
Encoder 1 Audio 1/2
Encoder 2
Encoder 2 Audio 1/2
Video Inputs
Encoder Mode
Encoder 1
Product
Network
ASI Outputs
IP Outputs
Encoder 2 Status
OK
Input Port
Video 2
Encoder 2 Video Input
OK
Signal
720x480i 59.94
Transport Rate (b/s)
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Output Rate (b/s)
5,390,254
Transmit Rate (b/s)
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Destination IP Address
10.10.9.12
Stream ID
Encoder 2
Encryption State
Secured OK
Connection State
Connected
Encryption Key
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Retransmitted Packets
0
SRT Packets Lost
0
SRT Packets Dropped
0
RTT
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Estimated BW (b/s)
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Status
Audio
Ancillary/VBI
Basic
...
SRT Statistics